Towards an agenda for user oriented research in the built environment

Jensen, Per Anker; Alexander, Keith; Fronczek-Munter, Aneta

Published in:
6. Nordic Conference on Construction Economics and Organisation

Publication date:
2011

Document Version
Early version, also known as pre-print

TOWARDS AN AGENDA FOR USER ORIENTED RESEARCH IN THE BUILT ENVIRONMENT

Per Anker Jensen
Centre for Facilities Management – Realdania Research, Technical University of Denmark
pank@man.dtu.dk

Keith Alexander
Centre for Facilities Management, Manchester, UK
keithalexander47@gmail.com

Aneta Fronczek-Munter
Centre for Facilities Management – Realdania Research, Technical University of Denmark
afmu@man.dtu.dk

The background for this paper is the authors' participation in user oriented research in relation to the built environment and an aim to provide input to the future research agenda in this area for instance in CIB, who has recently taken an initiative to increase research focus on clients and users.
The purpose is to present an overview of different approaches to user oriented research and propose directions for further research that can help to give the users a stronger position to impact the built environment they experience.
The methodology is a literature review of research approaches like usability, user involvement in briefing, user driven innovation and participatory design. The different research approaches are presented, analysed, compared, and evaluated.
The paper suggests that further research in this field is strongly needed. The different approaches vary in theoretical foundations, methodologies and development, but they are in most cases not incompatible and they use many similar research methods. Further research should focus more on direct interactions with and involvement of users and mostly qualitative research methods should be applied in real life situations or simulations.

KEYWORDS: Usability, built environment, briefing, user driven innovation, participatory design.

INTRODUCTION

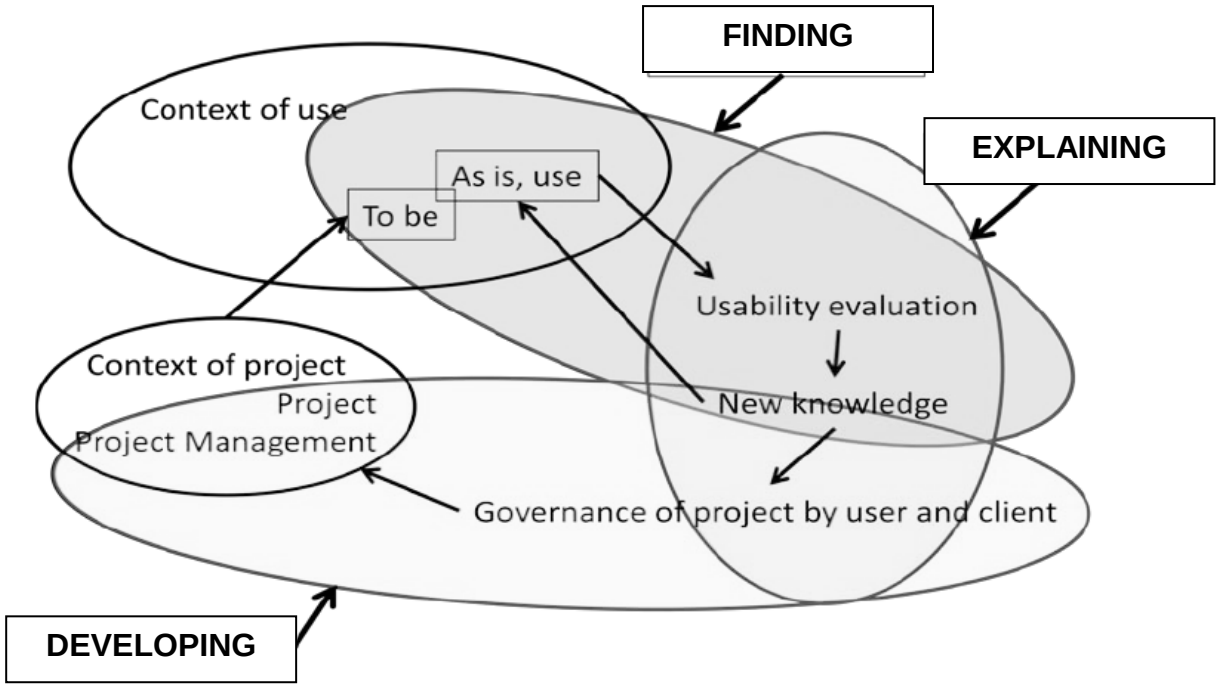
This paper aims to present current trends in user oriented research in the built environments and outline possible ways forward for research and practice to give the users a stronger position to impact the built environment they experience. The background is the authors' participation in user oriented research in relation to the built environment. This includes a leading role in CIB W111 Usability of Workplaces since its start. CIB has recently taken an initiative to increase research focus on clients and users by establishing a new working commission W118. This paper can be seen as an input to support this initiative but is also aimed at other researchers, institutions, funding organisations, and practitioners.

The starting point is a state of the art of recent research approaches like usability, user involvement in briefing, user driven innovation and user involvement in design. The methodology has been a literature review divided between the three authors according to their special areas of competences and fields of interest in relation to user oriented research. The paper has been developed during a number of meetings, a workshop, and exchanges of inputs and comments. The paper is exploratory and does not intend to cover all approaches of user oriented research. Areas like research on stakeholders and value management are for instance not included.

Recently, a large collaborative project on usability in the built environment - REBUS - was carried out in the Nordic countries with national projects in Finland, Norway and Sweden (Blakstad et al., 2010). One of the joint results was the model shown in Figure 1 which distinguish between the "As is" use situation and how new knowledge can be developed by usability evaluations and feed into action leading to a new "To be" situation. The overall management or governance of these processes is seen as crucial. The model was developed to map the different research carried out the three countries. For this paper we have used the REBUS model to map the different approaches of user oriented research that we have identified. For this purpose we have named the different places marked by the REBUS project as: Finding, Explaining and Developing. A fourth place could be Implementing or Executing, but this has not been relevant as part of this work.

The model is used as a basis for comparing the different research approaches towards the end of the paper after presenting the approaches. The paper is concluded with suggestions for further user oriented research.

Figure 1: REBUS model. Adapted from Blakstad et al. (2010)



RESEARCH PERSPECTIVES

Clients and Users

So far research concerning building clients has been very limited even though there has been an increasing interest in the role of the client in many of the policy reports and development programs that has been launched in several European countries during the last 15 years. However, the interest for the client has mostly been from a supply perspective with a focus on the clients' role in relation to building projects. A typical example is Bertelsen et al. (2002), who discuss the possibility of the client acting as a change agent in relation to the building process as opposed to a more passive role as procurer. A complete opposite role is seen for instance in Public-Private Partnerships, where even the role as procurer is outsourced to a private consortium leaving the public organisation to the role as tenant specifying the demand to be provided by the supply side.

A more balanced view of the role of building clients is shown in Figure 2, where the building client is seen as a mediator similar to client advisors and facilities managers. The mediators are placed between the demand side and the supply side, and their role is to specify the needs from the demand side translated into requirements or service levels, which is in accordance with the professional language of the providers from the supply side. The need for such mediators in building projects and Facilities Management (FM) provision is due to the complexity and specialised character of such deliveries.

Figure 2: Clients as mediators. Source: Jensen (2002)

Building clients and facilities managers are often an integrated part of the demand side organisation, and the demand and their roles are very dependent on which type of organisation they represent. In business management and in FM it is common to distinguish between strategic, tactical and operational levels of organisations and interaction between FM and the core business part of organisations. This is even part of a European FM standard, where it is further defined that the interaction is with the client at strategic level, with the customer at tactical level and with the end user at operational level (CEN/TC348, 2006). A similar distinction is not common in the construction industry.

Users of the built environment have been discussed in many previous studies, but according to Olsson, et al. (2010), the term user is often oversimplified by assuming that there is only one group of users. Instead, it is proposed to structure the users in a model for user

categorisation based on a supply chain approach. The proposed common user roles are following:

- Owners
- Facilities management and service personnel (operating the building)
- Management of the organisation based in the building
- Service providers (examples: teachers in a school, doctors and nurses in a hospital)
- Service receivers (examples: pupils in a school, patients in a hospital)
- Indirect service receivers (examples: child's parents, patients' relatives)

Other useful, though more simplified distinctions of users are between demand and supply side by Kernohan et al. (1992) and the three kinds of users: the user, the owner and the facility manager, by Sæbøe and Blakstad (2009).

There seems to be a strong need for more research on the building client taking a demand perspective and looking at the client as organisations and to distinguish between the different organisational levels in relation to building projects and the involvement of users.

Usability

The concept of Usability is defined in ISO 9241-11 as: *"The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use"* (ISO, 1998).

We have identified three different research traditions and perspectives. Usability engineering focuses on individual users of industrial products and IT-software. Usability and accessibility also focuses on individual users but in relation to the built environment and particularly the needs of less able users like disabled and elderly. Usability appraisal also focuses on the built environment, but the perspective is on users as parts of organisations seen from a FM point of view.

Usability Engineering

The concept of usability has its roots in evaluations of user interfaces of computer software and consumer products like electronic equipment. One of the seminal works is the American book by Jakob Nielsen (1993) on Usability Engineering. Here usability is seen in the context of system acceptability and as part of usefulness together with utility. The attributes of usability is defined as easy to learn, efficient to use, easy to remember, few errors, and subjectively pleasing.

Usability engineering is widely understood as Usability Testing, which is a method, where the already developed product prototype is being tested in a Usability Laboratory with a number of potential users to see if it is acceptable and useful for the target group members. That process will often lead to development of additional improvements and making a second prototype. Traditionally the manufacturing companies are themselves developing the prototypes, innovating and making patents in their R&D (Research and Development) departments and only invite the users for the Usability Testing. Even though the innovation by manufacturers and usability testing was and still is widespread in many fields, it has been shown that the traditional pattern of concentrating innovation support resources on a few individuals is hugely inefficient, because it is hard to determine the right people who might develop a valuable innovation (von Hippel, 2005). Usability testing is typical based on a man-machine relationship with individual users.

Usability and Accessibility

The concept of accessibility has over the last decades become increasingly important in relation to disability and the built environment. The concept has changed the focus from dealing mainly with physical access for wheelchair users towards enabling everybody, including persons with disability, to participate in the social and economic activities for which the built environment is intended. Accessibility is a basic feature of the built environment concerning the way in which housing, public buildings, places of work etc. can be reached and used.

The focus on accessibility was internationally brought forward by the United Nations, which in 1982 decided on a World Programme of Action on Disabled Persons and in 1993 agreed on Standard Rules on the Equalization of Opportunities for Persons with Disabilities (United Nations, 1994). This was followed by the European Concept for Accessibility in 1996, to be implemented in the national laws of all member countries. The European directive was based on the universal design principles, applicable to the design of buildings, infrastructure, and building and consumer products. The principles were the provision of safe and enjoyable environments that are accessible to everyone, and rejection of the division between able-bodied and disabled people (Goldsmith, 1997).

Iwarsson and Ståhl (2003) discuss the relation between accessibility, usability and universal design. Accessibility refers to compliance with official norms and standards, thus being mainly objective, while usability concerns fulfilment of functional requirements and is mainly subjective in nature based on individual interpretations. They see accessibility as a person-environment relationship and usability as a person-environment-activity relationship. They see usability as a more positive and complex term than accessibility and suggest that accessibility should be partly replaced by usability. They also highlight universal design as a more process-oriented and less stigmatizing concept than accessibility.

Inclusive Design is a further development from Universal Design. The first convention on Inclusive Design was held in London in 2000 and this led to the Stockholm declaration from 2004, where the definition of Inclusive Design was provided as “design for human diversity, social inclusion and equality” (Guida et al., 2008). I 2006 the United Nations adopted a Convention on the Rights of Persons with Disabilities, which unlike the World Programme from 1982 and the Standard Rules from 1993 is a legal binding document. It has to be ratified by the member countries and implemented in national legislation. Accessibility is one of the general principles of the convention (United Nations, 2006).

There has particularly in Sweden been some research of usability with focus on housing adaptations. An instrument for Usability in My Home (UIMH) has for instance been developed. This instrument is self-administered and consists of 16 items rated on a 7-graded scale targeting activity aspects, personal and social aspects and physical environmental aspects (Fänge and Iwarsson, 2003). This research appears to be very instrumental with a main focus on ergonomics.

Usability Appraisal

This section of the paper mainly draws upon the continuing research into the application of usability concepts to the built environment conducted by CIB W111 (Alexander, 2005, 2008 and 2010). The objectives of the research were achieved through a series of case studies and associated workshops designed to identify and evaluate the ways in which stakeholders in projects were involved in decision making about building use and the methods and tools they used. The research has enabled a number of broad conclusions about the nature of usability as

a concept and its application to the built environment and has challenged the basis of conventional approaches to briefing and post-occupancy evaluation.

In summary, the group sees usability as *'a cultural phenomenon that can only be improved through a better understanding of user experience, considered as situated action in a specific context'* (Alexander, 2008). The section discusses practical implications for built environment professions and for the development of management processes and raises specific issues for usability research in the built environment.

Much recent effort in construction research in Europe and particularly in the UK has been directed to creating 'a client-oriented, knowledge-based, value-based industry' (UK CTP/ECTP). Application of the concept of usability in the built environment presents a number of key challenges to conventional construction and property perspectives:

- User focus – usability places a focus on the user and the organisation rather than the building;
- Demand driven – usability recognises the dynamic requirements of organisations (and communities), derived from the strategic objectives;
- User experience – usability is primarily concerned with the perceptions of users rather than the intentions of designers and service providers;
- Contingency quality – usability is contingent on user values rather than an inherent function of the built environment;
- Context of use – consider facilities in the context of use rather than as a project (context of action);
- Process oriented - usability is considered as a process rather than as product or service provision;
- Service production – like all services, facilities are co-produced by service users;
- Relationship management – usability implies changing relationships with users;
- Learning process – usability exchange of knowledge amongst users, managers and service providers.

Fenker (2008) relates usability to user experiences and social relations between users and facilities and describes usability as a process that can only be understood as a social construction where the building act as a sort of stage. According to Fenker, '*...the artefacts are bearers of a set of possibilities and constraints as well as, most importantly, activity and social practices*'.

This was also reflected in the chosen theme of the recent CIB W70 conference in Sao Paulo – 'FM and the experience economy'. In his opening address, Da Graca (2009) introduced familiar themes that have been central to the Usability work over the past 10 years (following Pine and Gilmour's seminal work in service marketing) and argues that these should now be the focus of FM responsibilities. In the preface to the conference proceedings, Da Graca (2010) stressed the need to open the way to demand management focusing on the user experience. We need to understand user behaviour, user needs and user experiences and more: we need to manage and systematize the user experience (in a broad sense). We need to learn how to design experiences. Good FM briefings with good design. We have the necessary tools but we need to put them to work. He suggests that research in this area is essential. We need to practice FM which focuses on the User Experience (UX), looking at the demand side, managing experiences and putting the resources to work.

The most known assessment methodology for buildings is Post Occupancy Evaluation (POE), used since the 1960s. 'Post occupancy' refers to the fact that the building is already taken to use at the point of evaluation. According to the definition of Preiser et al. (1988, 2005), POE is *"the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time"*. Conventionally, POE is carried out by trained professionals or researchers and the building occupants would answer questionnaires, participate in interviews and workshops.

The British Council for Offices (BCO) suggests two main purposes for a POE. The main aim is to gain feedback of how successful the workplace is in supporting the occupying organisation and individual end-users. The other purpose is to use POE to assess if a project brief – the programme of requirements, has been met.

Contingent user values are not easy to explore using conventional techniques such as POE and there have been calls for multi-method approaches (Blakstad et al., 2008) and a greater range of methods for understanding user experience (Alexander, 2008).

Usability evaluations are based on different user's experiences and assessments on how well the buildings perform regarding different parameters. A building's performance can never be seen or understood isolated from an organisational and technical perspective, as those aspects interact and influence each other. Usability has hence a complex nature and can be described as a "wicked problem" (Blakstad et al., 2008). Such problems are characterized by no definitive formulation of solutions, and they are open to multiple interpretations (Rittel and Webber, 1973). According to Blakstad, an adequate approach to "wicked problems" will require multi-method strategies using a triangulation of methods and evaluations with multiple perspectives.

This is in line with findings from previous studies showing that evaluations work best when they are based on several methods and aspects, depending on objective, purpose, focus, competence and resources (Frechtling, 2002). All this implies that usability evaluations are complex, that there is a need for simplification and that the evaluator possesses both theoretical and practical knowledge and skills (Baird et al., 1996). Blakstad et al. (2008) describes how different methods and tools were explored and tested according to their relevance and validity for usability in several Norwegian cases. As pointed out earlier, few of the available methodologies aim directly at evaluation of usability related to organizational objectives. However, they found that many traditional research and evaluation methods had potential to be developed for the purpose of usability evaluation.

User Involvement and Briefing

The traditional view is that briefing takes place before the design starts and the resulting briefing documents should contain the client's requirements for the building design. The brief is usually written by experts. Users are mainly involved as data sources, for instance via interviews and meetings with the experts. According to Nutt (1993), the nature and pace of change has challenged the simple basis of the traditional brief and exposed the limitations in the logic of its process. The future needs cannot be forecasted with confidence, hence the need for a dynamic process.

Prins et al., (2006) discuss the difference between static and dynamic briefing in relation to various procurement routes. They conclude that briefing has to include a well-balanced level of dynamic as well as static aspects. However, indirectly it seems to indicate an important distinction between briefing as a process and a brief as a document (or collection of

documents). The brief as a document is basically static, while briefing is, or should be, a dynamic process – at least in projects with an individual design. This suggests that briefing is more than writing briefs, and dynamic briefing should be a process of feedback to, and dialogue with, all stakeholders. Several authors regard briefing as an almost continuous process, for instance Barrett and Stanley (1999), Blyth and Worthington (2010), Fristedt and Ryd (2004), van der Voordt and van Wegen (2005), and Jensen (2006).

Nutt (1993) proposed the need for a strategic brief and also a facilities management brief - the former to provide a better link between the business operations and the building and the latter to include the operation and development of buildings through their lifetime. One of the main purposes of strategic briefing and user involvement in the briefing process is to ensure an alignment between on the one side business strategy and work process and on the other side the design of building and workplaces (Blyth and Worthington, 2001; Jensen, 2006). Fristedt & Ryd (2004) adopt the idea of strategic briefing as an activity in the pre-project phase, but they compliment the strategic brief by a tactical brief in the design phase and an operative brief for the construction phase.

From a review of the literature it is evident that there is no unified and generally accepted new way of briefing. However, there are some clear trends away from the traditional way of briefing towards what in a recent book has been called inclusive briefing (Jensen and Pedersen, 2009). Inclusive briefing is an interactive process, where the demand and supply sides are involved in a mutual dialogue process. Briefing concerns all the clients' and users' needs in developing a facility and is a continuing process with changing focus in different phases. Briefing is a process involving experts, but the experts are facilitating a guided learning and dialogue process with client and user representatives. The users should be actively involved, for instance in commenting on design solutions, and the involvement of the users is particularly crucial in building projects that are part of a corporate change process like introduction of new organisation, technology and ways of working. The end result of the briefing process is the acceptance of solutions, which have been developed based on a brief.

The recent work by CIB W111 on Usability has highlighted the importance of briefing as a means to achieve usability. However, this finding itself raises a further series of issues and a possible agenda for future research and has interesting implications for the way we think about briefing, particularly when usability is seen as a contingent quality rather than as the inherent functionality of the physical environment. Hudson (forthcoming) argues that much of the existing work on briefing is based on premises that it can be reduced to a rational process, it is part of a finite project, that the final outcomes of this project are buildings or other physical facilities and that user requirements have an external objective existence that can be captured in the briefing process. He goes on to suggest that work on usability suggests that these premises are limited and that a new approach to briefing may be necessary. This approach might be characterised by an emphasis of briefing as creative exploration of possibilities rather than requirements capture, a focus on the social construction of requirements and their evolution over time and a focus on human satisfaction rather than physical facilities.

Some of the characteristics of traditional, inclusive and usability briefing are summarised in Table 1.

Table 1: Traditional, inclusive and usability briefing. Adapted from Jensen and Pedersen (2009)

Traditional briefing	**Inclusive briefing**	**Usability briefing**
Concerns new building/construction	Concerns all client/user needs in developing facilities	Concerns user needs in existing facilities
A definite phase at an initial stage of construction	A continuous process with changing focus in different phases of building life cycle	A continuous process at different phases during occupancy
An expert based information collection	A guided learning and dialogue process	A co-learning process
Users mainly involved as data sources	Users actively involved as part of a corporate change process	Users as co-producers
The result is a brief, i.e. a requirement specification	The result is acceptance of solutions based on a brief	Brief as an evolving 'bulletin board'

Jensen (2006) has identified the following reasons as the most important for involving users in the briefing process:

- Ensure that new facilities are designed in accordance with the needs and intentions of the organisation
- Learn from good and bad experiences with existing facilities
- Ensure acceptance and appreciation of the new facilities among managers and staff

There is a need for further research in the role of the users in the briefing process and how to manage inclusive and continuous briefing with user involvement. There is also a need for research that evaluates the effects of user involvement for different types of users, processes, facilities and national cultures.

User Driven Innovation

According to von Hippel (2005), innovation is nowadays being democratized, and it is no longer just manufactures, but users of products and services that are innovating. In the traditional, manufacturer-centric model of innovation, the users' role is to have needs and the producer's role is to identify them and satisfy them by new products. In a user-centric model, manufactures invite lead users for usability testing and simulations, where the advanced users can find additional improvements for developing the next prototypes. Furthermore, he claims that most innovating users have characteristics of lead users - they are ahead of the majority of users in their populations with respect to an important market trend.

Ehn & Kyng (1987, in von Hippel, 2005) define user driven innovation as introducing a groundbreaking change - now innovation and design is not done 'with' nor 'for' users, but 'by' users! In the recent years, we have seen in some fields that it is truly the users, who are first to develop new consumer products, as the computer software and communication possibilities are steadily growing, resulting in user-centric or user driven innovation. The surprising empirical finding is that users often freely reveal their innovations. The practices visible in "open source" software development were important in bringing this phenomenon to general awareness (von Hippel, 2005).

According to Danish Enterprise and Construction Authority (2010), User driven innovation methods can be divided into three groups:

1. Lead user approach – first mentioned by von Hippel, where lead users are gathered with the project team at workshops, make rapid prototyping, then R&D department develops the product further
2. Ethnographical approach – the aim is to find the needs, both known and tacit, by studying the users in their everyday situations, the used tools can be: observations, workshops, interviews
3. Participatory design /innovation - the users are co-designers, methods can vary and are chosen to fit the exact project

The recent shift to User driven innovation has very attractive qualities. Von Hippel describes two of them. First of all users can get precisely what they want by designing it for themselves. Secondly the innovation by users appears to increase social welfare. Nevertheless there are some challenges to obtain a widespread use of User driven innovation. The manufactures must be able to apply the needed fundamental changes. Moreover, the governmental policy and legislation should stop supporting the manufacturers-innovation only (von Hippel, 2005). Furthermore, von Hippel (2005) summarises the various qualities of User driven innovation in his book Democratizing Innovation, like this: "Users' ability to innovate is improving radically and rapidly as a result of the steadily improving quality of computer software and hardware, improved access to easy-to-use tools and components for innovation, and access to a steadily richer innovation commons." In addition to that, he predicts, that innovation by users will continue to grow, even if both users and manufactures have a constant willingness to invest in obtaining a precisely right product.

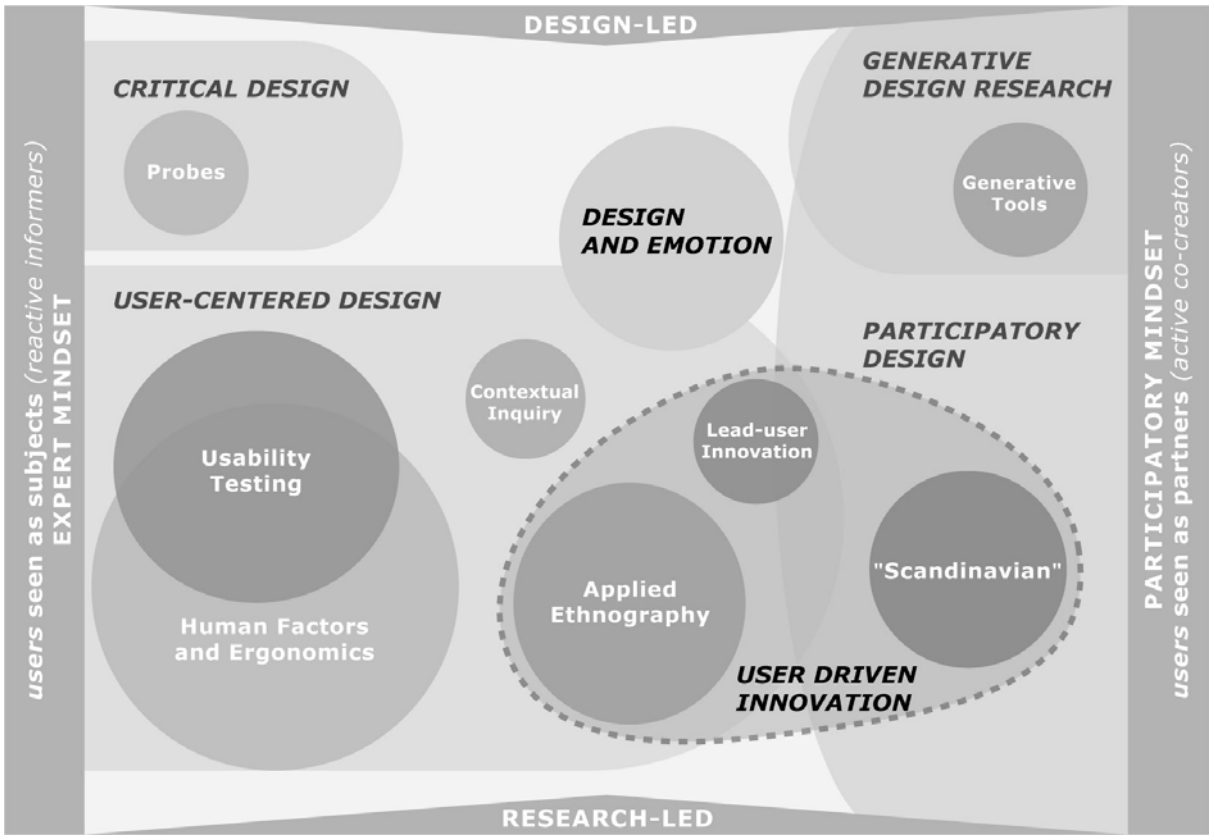
Research in user driven innovation has had a strong focus on products and software. As innovation by users is predicted to grow in the society, it is worth further examining of the possibilities of user driven innovation in the building sector. Furthermore, the different methods like workshops, rapid prototyping, simulations, interviews and observations can be applied and tested further in different stages of the design process.

User Involvement in Design

In recent years there has been growth and exploration of different approaches to design research. As some of them are complementary and others competing, the result was a confusing mess. Recently a visual map was presented by Sanders (2006) and Sanders & Chan (2007), which organises the landscape of design research and many of the approaches to user involvement, see Figure 3. The different approaches are positioned in the framework with two axes. The vertical axis is stretching from design-led to research-led, while the horizontal axis is stretching from an expert mindset, where users are informants and design is FOR people, to participatory mindset, where users are co-creators and design is made WITH people.

The largest area on the map is covered by the *User-centered design*, which is most developed according to the authors, and aims at developing products and services to better meet the needs of users. The approach is research-led with expert mindset. The main methods are *Human factors and ergonomics, Usability testing* and *Applied ethnography*.

Figure 3: Emerging trends in design research. Adapted from Sanders (2006)



Another large zone is *Participatory design*, which can be both design-led and research-led, and actively involves users throughout the design development. The origins date back to trade union movements in Scandinavia in the 1960s and later spread to other fields. For example the new trend was noticed in software design by Floyd *et al*. (1989), who described a couple of main characteristics of the new *Scandinavian approach*. The most important was the cooperation between developers and users, considered to be a crucial factor and getting methodological support. Furthermore, various forms of prototyping were used to provide technical support for the process of mutual learning. Users were getting help to progressively qualify themselves for the process. In addition to this the traditional participation, approaches were extended by adoption of two principles - mutual learning and designing by doing.

Mutual learning, also called co-learning means, that both users and developers are reliant on the mutual process of learning and communicating. *Designing by doing* means that experimentation and testing takes place already in early stages of a project, such as using fast prototyping and promoting communication and learning processes. Last, but not least a new concept of Co-creation arrived. Examples of the collective process, communication and co-creation of workplaces are described by Granath (1998). Moreover, Sanders & Chan (2007) add another characteristic to participatory design – "the use of physical artefacts as thinking tools throughout the design process". Those tools - boundary objects - have been explored by researchers as Clarke and Fujimura (1992), Granath (1998), Kjølle and Gustafsson (2010). Recent examples of further research on participatory design are Broberg (2009, 2010), Binder and Brandt (2008), Peek and Geurts (2010), Våland (2010).

Lead-user innovation, as described by von Hippel (2005), is located in the map as a small overlap between User-centred design and Participatory design. If the definition of User driven innovation is broadened, as by the Danish Enterprise and Construction Authority (2010), then the overlap is covering the Scandinavian participatory design and Applied ethnography as well – see Figure 3.

Three other design categories described by Sanders & Chan (2007) are worth mentioning: *Affirmative design*, *Critical design* and *Generative Design*. Affirmative design, according to Dunne & Raby (2001, in Sanders & Chan, 2007) "reinforces how things are now", conforms to the expectations and is the most used in design. Critical design rejects "how things are now" and provides alternatives to design and values. Generative design, on the other hand, focuses on creating tools for non-designers and empowering them to express their dreams for future or make their own alternatives to the current situation. Generative design is a part of the Participatory design zone, and is design-led.

It seems like there is a strong development of research in border area between User-centred design and Participatory design. Further research could explore the boundaries and the growing overlap of the two zones, as well as particular effects on specific fields, like the built environment.

COMPARISON OF APPROACHES AND TRENDS

The preceding section presented a number of different approaches of user oriented research. Research in relation to usability was divided in usability engineering with a focus on individual users of industrial products and IT-software, usability and accessibility with a focus on individual less able users of the built environment and usability appraisal with a focus on organisational users of the built environment. Usability appraisal is related to POE, but is distinguished by a stronger focus on feed-forward to the user organisation rather than feedback to the designers.

User involvement in briefing is specifically related to produce input into building design. User driven innovation is a broader concept coming from industrial product development with lead user innovation as a specific method. Participatory design is also a broad concept. When relating these concepts to the built environment, it seems important to distinguish between conceptual design and the physical design. The conceptual design focuses on the organisational needs of users and search for principal solutions to the configuration of functions and space. Briefing and user driven innovation can be part of this. Participatory design is more related to the physical design process.

Table 2 shows a comparison of these eight approaches in relation to purpose, typical setting of the user interaction, the place in the REBUS-model in Figure 1, and our estimation of their stage of development (status). We have as mentioned the introduction defined the places as Finding, Explaining and Developing. The five approaches Usability appraisal, POE, User involvement in briefing, User driven innovation and Lead user innovation all take a starting point in Finding and this is the main focus of POE, while Usability appraisal and User involvement in briefing also can include Explaining and Development, just like User driven innovation and Lead user innovation usually cover all three places. The three remaining approaches – Usability engineering, Usability and accessibility, and Participatory design – all have their main focus on Developing.

Table 2: Comparison of approaches of user orientation

Approach	**Purpose**	**Setting**	**Place in REBUS-model**	**Status**
Usability Engineering	Prototype testing of consumer products	Laboratory	Developing	Established
Usability and Accessibility	Design for disability, universal and inclusive design	Design office	Developing	Established
Usability Appraisal	Evaluation - feedforward (+ requirements and exploration of possibilities)	Existing facilities	Finding (+ Explaining + Developing)	In development
Post Occupancy Evaluation (POE)	Evaluation - feedback	Existing facilities	Finding	Established
User Involvement in Briefing - Traditional, Inclusive Usability	Define user requirements (+ dialogue and approval of building design solutions)	Existing facilities (+ design office)	Finding (+ Explaining + Developing)	In development
User Driven Innovation	Develop new products, processes or services and new or existing building design	Observation and interviews in existing facilities, workshops and/or innovation camps	Finding + Explaining + Developing	Emergent
Lead User Innovation	Develop new products or processes	Workshops and prototyping in R&D department	Finding + Explaining + Developing	In development
Participatory Design	Develop new or existing building designs in a dialogue process	Existing facilities, workshops and design offices	Developing	Established

The development of the user oriented approaches show two completely opposite trends. One trend is towards increased generality were the facilities should be usable for everybody and/or for changing purposes. This is expressed in the demands for universal design and adaptability. The other trend is towards increased specificity were facilities should be usable for specific activities. This is expressed in the focus on for instance optimal learning environments, healing architecture and housing adaptations for elderly. A way to compromise these divergent considerations could be to make the basic building dimensions and common areas like access, circulation and amenity areas as general as possible and make the specific activity areas as fit for purpose as possible.

SUGGESTIONS FOR FURTHER USER ORIENTED RESEARCH

This paper suggests that further research in the field of user orientation of the built environment is strongly needed. The literature review shows that the different approaches vary in theoretical foundations, methodologies and stage of development, but they are in most cases not incompatible and they use many similar research methods. Further research should focus more on direct interactions with and involvement of users and mostly qualitative research methods are needed. It is important to distinguish between different types of users and apply methodologies involving users both as individuals and in groups and organisations.

The following list a number of suggestions for future research. The suggestions are listed according to the places in the REBUS-model in Figure 1 as used in Table 2. Some of the suggestions are based on the REBUS-report (Blakstad et al., 2010) as indicated in brackets.

Finding

Approaches with focus on evaluation of the 'as is' situation could benefit from research in the following areas:

- Understanding building clients as organisations (strategic/tactical/operational)
- Role of the users in briefing etc. (REBUS)
- Evaluation of the effects of user involvement
    - For different types of users, processes, facilities and national cultures
- Management of the processes of evaluating usability (REBUS)

Explaining

Approaches with focus on creation of new understanding of the 'as is' situation and how it can be changed to a new 'to be' situation could benefit from research in the following areas:

- Knowledge management of transfer of usability data
- User involvement and tacit knowledge
- Usability briefing
- Investigation of feedback and feed-forward (REBUS)
- IT support of information flows (REBUS)

Developing

Approaches with focus on creation of a new 'to be' situation could benefit from research in the following areas:

- Management of continuous and inclusive briefing
- Briefing as creative exploration of possibilities
- User driven innovation in refurbishing, renovation and housing adaptations
- Agile management of participatory design
- Simulation as method for user driven innovation
- Management of decisions on strategic, tactical and strategic levels
- Management of user experiences

It should be stressed that this paper and these results are part of work in progress and does not intend to cover all aspects of user oriented research in the built environment. Thus, it should be seen as a contribution to the further development of this important area of research.

ACKNOWLEDGEMENTS

We would like to thank the reviewer's for their comments. As part of the revision of the paper we arranged a workshop 22 February 2011, which besides the authors had participation by Geir Hansen, NTNU, Trondheim, and we thank him for his contributions. We also would like to acknowledge the participants in the REBUS project for the inspiration they have provided to the work on this paper.

REFERENCES

Alexander, K. (2005): *Usability of Workplaces: Report on Case Studies*, CIB Report, Publication 306.

Alexander, K. (2008): *Usability of Workplaces – Phase 2*, CIB Report, Publication 316.

Alexander, K. (2010): *Usability of Workplaces – Phase 3*, CIB Report, Publication 330,

Baird, G. et al. (1996): *Building Evaluation Techniques*. New York, McGraw-Hill.

Barrett, P. and Stanley, C. (1999): *Better Construction Briefing.* Blackwell Science.

Bertelsen, S., Fuhr Petersen, K. and Davidsen, H. (2002): *Bygherren som forandringsagent-på vej mod en ny byggekultur (The Client as Change Agent – Towards a New Culture in Building).* Bygherreforeningen i Danmark, Fonden Realdania, Byggecentrum, Denmark.

Binder, T. and Brandt, E. (2008), *The Design:Lab as Platform in Participatory Design Research.* CoDesign Vol.4 No.2, 115-129. Taylor & Francis.

Blakstad S.H., Hansen G.K. and Knudsen, W. (2008):'*Methods & tools for evaluation of usability in Buildings*', In Alexander, K. (2008).

Blakstad, S.H., Lindahl, G. and Nenonen, S (2010): *User-oriented Benchmarking for Usability of Real Estate - The REBUS research project*. Chalmers University of Technology. Gothenburg.

Blyth, A. and Worthington, J. (2010): *Managing the Brief for Better Design.* Second Edition. Spon Press.

Broberg, O. (2010): *Workspace Design: A Case Study Applying Participatory Design Principles of Healthy Workspaces in an Industrial Setting.* Int. J. Technology Management, Vol.51, no.1, 2010, Inderscience Enterprises Ltd.

CEN/TC 348 (2006): F*acility Management – Part 1: Terms and definitions*. EN 15221-1.

Clarke, A. E. and Fujimura, J. H. (1992): *The Right Tools for the Job: at Work in Twentieth-Century Life Sciences.* Princeton University Press. in Kjølle K. H. and Gustafsson C.: *Boundary objects in design.* in Atkin B. and Borgbrant J.: Performance Improvement in Construction Management. Spon Press, London and New York

Da Graca, M.E.A. (2010): *Preface: FM in the Experience Economy*, in Proceedings, CIB W70 Conference, Sao Paulo, Brazil;

Danish Enterprise and Construction Authority (2009): *User-driven innovation programme, Ministry for Economic and Business Affairs.* Webpage accessed 29-11-2010 at: http://www.ebst.dk/brugerdreveninnovation.dk/metoder

Fänge, A. and Iwarsson, S. (2003): *Accessibility and usability in housing: Construct validity and implications for research and practice*. Disability and Rehabilitation, Vol. 25, No. 2, 316-325.

Fenker, M. (2008): *Towards a theoretical framework for usability of buildings*. In Alexander, K. (2008).

Floyd, C., Mehl, W.-M., Reisin, F.-M., Schmidt, G. and Wolf, G. (1989): *Out of Scandinavia: Alternative approaches to Software Design and Systems development.* Human-Computer Interaction, Volume 4, pp. 253-350.

Frechtling, J., (2002): *The 2002 User-Friendly Handbook for Project Evaluation*, National Science Foundation, Directorate for Education and Human Resources, Arlington, USA.

Fristedt, S. & Ryd, N. (2004): *Att lyckas med program – Kontinuerligt programarbete för bättre styrning av byggnadsprojekt (To succeed with brief – continuous briefing for better building project management).* Arkus, Stockholm.

Goldsmith, S. (1997): *Designing for the Disabled – The New Paradigm.* Architectural Press. Oxford.

Granath, J.A (2001) *Architecture – Participation of Users in Design Activities*, Gothenburg, Chalmers Technical University.

Granath, J.A. (1998): *Workplace Making – A Strategic Activity*. Journal of Corporate Real Estate Vol.1 No. 2, Henry Stewart Publications

Guida, A., Dimitrijevic, B. and Pagliuca, A. (2008): *Inclusive Design for the Conversation of Built Heritage: Two Examples in Matera, Italy.* In Proceedings of CIB W070 Conference in Facilities Management: Healthy and Creative Environments. Heriot Watt University, Edinburgh, 16-18 June 2008, pp. 1-8.

Hudson, J., (forthcoming): *Briefing for Usability*, in Alexander, K.: *Usability in the Built Environment* (forthcoming).

ISO (1998): *Guidance on Usability.* ISO 9241-11.

Iwarsson, S. and Ståhl, A. (2003): Accessibility, usability and universal design – positioning and definition of concepts describing person-environments. *Disability and Rehabilitation*, Vol. 25, No. 2, 57-66.

Jensen, P. A. (2006): *Continuous Briefing and User Participation in Building Projects.* In: Proceedings.of the joint CIB, Tensinet, IASS International Conference on Adaptability in Design and Construction. Eindhoven University of Technology, Netherlands .

Jensen, P.A (2011*): Inclusive Briefing and User Involvement: Case Study of a Media Centre in Denmark.* Architectural engineering and design management, Vol. 7, 38-49.

Jensen, P.A. (2002): *Byggeri - fra vision til ny virkelighed (Building - from Vision to New Reality)*. Forlaget Tegl, 2002. Denmark.

Jensen, P.A. and Pedersen, E.F. (2009): User involvement and the role of briefing. Chapter in the book: Stephen Emmitt, Matthijs Prins and Ad den Otter (Eds.): *Architectural Management – International Research and Practice*, Wiley-Blackwell.

Kernohan, D., Gray, J., Daish, J. and Joiner, D. (1992): *User participation in building design and management.* Butterworth-Heinemann. UK.

Kjølle, K. H. and Gustafsson, C. (2010): *Boundary Objects in Design*, in Atkin B. and Borgbrant J.: *Performance Improvement in Construction Management*. Spon Press, London and New York

Nielsen, J. (1993): *Usability Engineering*. Morgan Kaufmann. San Fransico.

Nutt, B.: (1993): *The Strategic Brief*. Facilities, Vol. 11, No. 9, 28-32.

Olsson, N.O.E., Blakstad, S.H. and Hansen, G.K. (2010): 'Who is the user', in Proceedings CIB W70 Conference, Sao Paolo, Brazil.

Peek, G.-J. and Geurts, J.L.A. (2010): *Participative Design Tools in Inner-City Redevelopment.* in Atkin B. and Borgbrant J.: Performance Improvement in Construction Management. Spon Press, London and New York.

Preiser, W. and Vischer, J.(Ed.) (2005): *Assessing Building Performance.* Elsevier.

Prins M., Koolwijk J., Volker, L. and Wamelink J.M.F. (2006): *Briefing: Static or Dynamic?* In: Proceedings of the joint CIB, Tensinet, IASS International Conference on Adaptability in Design and Construction. Eindhoven University of Technology, Netherlands.

Rittel, H.W.J. and Webber, M.M. (1973): *Dilemmas in a General Theory of Planning*. In Working papers from the Urban and Regional Development. University of California Berkley.

Sanders, E.B.-N. (2006): *Design Research in 2006. Design Research Quarterly,* V.1.1. September 2006. Design Research Society.

Sanders, E.B.-N. and Chan, P.K. (2007): *Emerging trends in design research, changes overtime in the landscape of design research.* IASDR07 International Association of Societies of Design Research. The Hong Kong Polytechnic University, School of Design

Seim, R. and Broberg, O. (2010): *Participatory Workspace Design: A New Approach for Ergonomists?* International Journal of Industrial Ergonomics 40 (2010), 25-33. Elsevier.

Sæbøe, O.E. and Blakstad, S.H. (2009): *Fasilitetsstyring. Verdiskaping – Verdiøkning - Verdibevaring (Facilities Management – Value Creation – Value Adding – Value Sustaining).* Temahefte 2: Eiendomsutvikling og forvaltning. Tapir forlag. Trondheim

United Nations (1994): *Standard Rules on Equal Opportunities for Persons with Disabilities.* New York.

United Nations (2006): *Convention on the Rights of Persons with Disabilities*. New York.

Våland, M. S. (2010): *What We Talk About When We Talk About Space: End User Participation between Processes of Organisational and Architectural Design.* Copenhagen Business School, Doctoral School of Organisation and Management Studies. PhD Series.

van der Voordt, T.J.M. and van Wegen, H.B.R. (2005): *Architecture in Use – An introduction to the programming, design and evaluation of buildings.* Architectural Press, Elsevier, Oxford.

Vischer, Jacqueline C.(2008), 'Towards a user-centred theory of the built environment', Building Research & Information, 36:3, 231 — 240.

von Hippel, E. (2005): *Democratizing Innovation.* MIT Press.